

CITY OF MOUNTAIN VIEW**ENVIRONMENTAL PLANNING COMMISSION****STAFF REPORT****WEDNESDAY, SEPTEMBER 2, 2015****5. PUBLIC HEARINGS****5.1 Public Hearing for Consideration of a City-Initiated Building Code Amendment Regarding Electric Vehicle Readiness.****RECOMMENDATION**

That the Environmental Planning Commission (EPC) recommends that the City Council adopt:

1. An Electric Vehicle Readiness Ordinance amending Chapter 8 of the City Code requiring that all new construction provide for the current or future installation of electric vehicle chargers (Exhibit 1).

PUBLIC NOTIFICATION

The Commission's agenda is advertised on Channel 26, and the agenda and this report appear on the City's Internet website. A City Council meeting will be held regarding this project, and interested parties will be notified.

PURPOSE AND SUGGESTED MEETING PROCEDURE

The purpose of this meeting is to present the Electric Vehicle Readiness Ordinance to the EPC for a formal recommendation to the City Council.

Staff recommends the following meeting procedures, which reflects standard practice for this type of item:

1. Staff presentation.
2. Commission questions.
3. Public comments.
4. Commission discussion and recommendation.

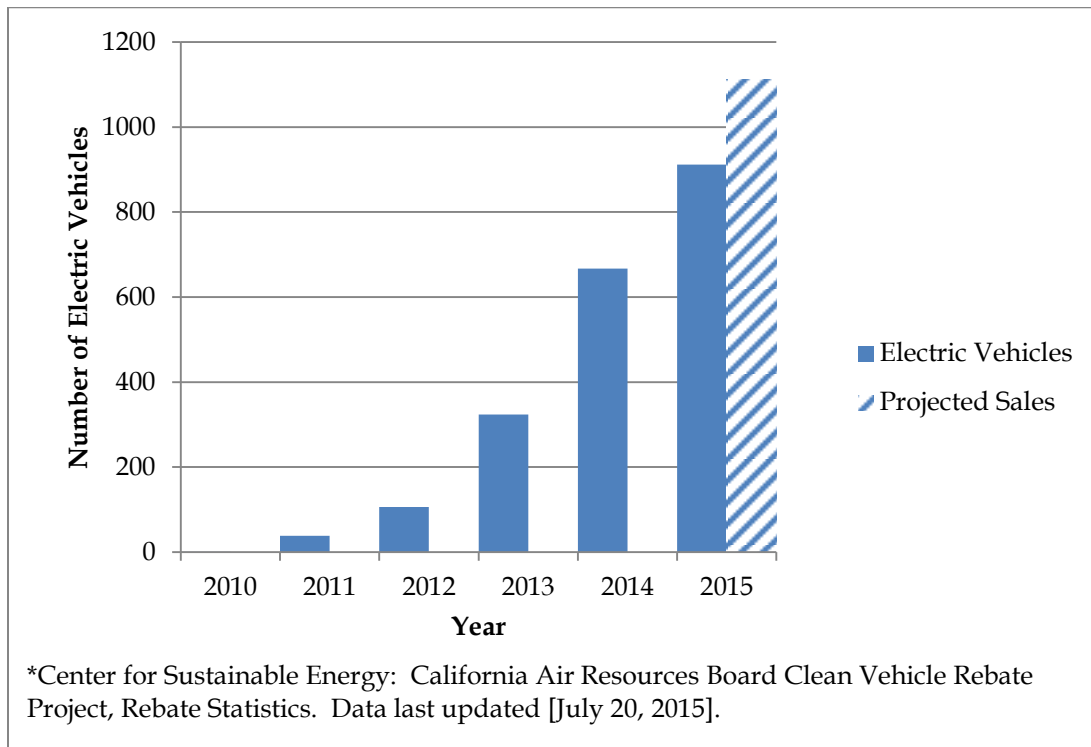
BACKGROUND AND ANALYSIS

Transportation sources account for well over half the emissions that contribute to ozone and particulate matter in California. In order to help meet California's health-based air-quality standards and greenhouse gas emission reduction goals, significant gains, such as investing in electric vehicle (EV) infrastructure, are needed in the transportation sector.

Governor Brown's Executive Order of March 2012 directs State and local governments to support and facilitate the rapid commercialization of zero-emission vehicles (ZEVs), with a target of having 1.5 million ZEVs on California roadways by 2025. In order to meet this goal, it is important that facilities be readily available to provide convenient charging stations for EVs.

The United States leads the world in total number of EVs. Santa Clara County leads the country in EV sales. According to the California Center for Sustainable Energy, there are 7.38 EVs per 1,000 people in the County, with a total of 13,745 vehicles (June 2015). Compared to similar sized cities, Mountain View has the most EVs in the County at 12.32 EVs per 1,000 residents (July 2015). Current purchasing trends indicate that by the end of 2015, there will be 15 EVs per 1,000 residents in Mountain View. Figure 1 depicts the past and current growth of EV ownership in Mountain View with data from the Clean Vehicle Rebate Project Statistics. These statistics only include purchases of EVs by residents of Mountain View in which rebates were received.

Figure 1: Growth of Electric Vehicle Ownership in the City of Mountain View



The rising number of EVs in Mountain View requires building standards to meet the resulting infrastructure demand. The proposed ordinance responds to these demands while encouraging and supporting the use of EVs as an alternate means of transportation. The Electric Vehicle Readiness Ordinance is intended to provide low-cost strategies that offer choice and savings in design for homeowners, employees, and consumers wishing to purchase an EV without necessitating retroactive installation of higher-capacity electric wiring and supply equipment for charging EVs.

Mountain View 2030 General Plan

The Mountain View 2030 General Plan supports increasing EV use and its accompanying infrastructure through the following General Plan policies:

MOB 9.3: Low-emission vehicles. Promote use of fuel-efficient, alternative fuel and low-emission vehicles.

INC 1.6: Sustainable materials. Promote the use of sustainable or green materials and products.

INC 13.2: Alternatives to gasoline. Promote and increase the use of new technologies as alternatives and supplements to gasoline in vehicles throughout the community.

INC 20.3: Pollution-reduction technologies. Encourage the use of nonfossil fuels and other pollution-reduction technologies in transportation, machinery, and industrial processes.

Technical Definitions and Information

The following are technical definitions used in this report. Additional technical information is attached to this report.




CalEPA	California Environmental Protection Agency
CalGreen	2013 California Green Building Standards Code
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
IEA	International Energy Agency
V	Volt
ZEV	Zero-Emission Vehicle

Existing and Proposed Requirements

Existing Requirements

Table 1 lists the City's existing requirements (adopted from CalGreen) regarding EV charging infrastructure.

Table 1: CalGreen Building Code Requirements

	Type of New Construction	 Conduit Only	 EVSE-Ready Outlet	 EVSE Installed
CalGreen Mandatory Measures¹	Residential Unit with Attached Private Parking	1/unit		
	17 Multi-Family Units or More	3%		
	Nonresidential	3%		
CalGreen Tier 1 Voluntary Measures²	Residential Unit with Attached Private Parking	1/unit		
	17 Multi-Family Units or More	5%		
	Nonresidential	4%		
CalGreen Tier 2 Voluntary Measures	Residential Unit with Attached Private Parking	1/unit		
	17 Multi-Family Units or More	5%		
	Nonresidential	6%		

Note: All requirements are for Level 2 EVSE, as described below.

¹ Adopted by the City.




² Included in the North Bayshore Precise Plan.

Proposed Requirements

The Electric Vehicle Readiness Ordinance proposes a substantial increase in EV charging infrastructure requirements for all new construction, both public and private. The proposed ordinance outlines a three-category combination of **Conduit Only**, **EVSE-Ready Outlets**, and **EVSE Installed** for all new construction. All requirements are based on the industry standard of Level 2 chargers capable of charging at 30 amperes or higher at 208 or 240 volts (V). For an explanation of the three levels of chargers, see Exhibit 4.

Table 2 summarizes the proposed requirements, with written descriptions of the requirements below. Tables 1 and 2 are structured differently to most accurately represent the CalGreen and Electric Vehicle Readiness Ordinance regulations.

Table 2: Electric Vehicle Readiness Ordinance Summary Table

Land Use	Type of Parking			
		Conduit Only	EVSE-Ready Outlet	EVSE Installed
New One- and Two-Family Residential	Resident Parking	1/unit		
New Multi-Family Residential (Attached Private Parking)	Resident Parking	1/unit		
	Guest Parking	15%		
	Accessible Parking	15%		
New Multi-Family Residential (Nondeeded Parking)	Resident Parking	50%		
	Guest Parking	15%		
	Accessible Parking	15%		
New Nonresidential	Total Parking	15%		
	Accessible Parking	15%		

Note: All requirements are for Level 2 EVSE.

Note: New construction is defined as a building that has never before been used or occupied for any purpose and does not include additions, alterations, or repairs.

The first category requires “Conduit Only,” in which a raceway and panel capacity is installed at the time of construction. The second category requires an “EVSE-Ready Outlet,” such that little or no additional work is required to install an EVSE.

The third category requires an “EVSE Installed” parking space that contains an installed Level 2 charger.

General Provisions

1. Property owners provide minimum circuit capacity sufficient to ensure electrical service will be able to accommodate future installation of EV chargers in all spaces where an outlet or conduit are provided.
2. Conduit Only, EVSE-Ready Outlet, or EVSE Installed be provided for accessible parking spaces, in ratios consistent with the requirements of nonaccessible parking spaces, with the condition that parking will not be restricted to EVs in accessible spaces with EV equipment or infrastructure.
3. The Conduit, Outlet, or EVSE required by the ordinance be located to provide convenient access, subject to guidelines to be established by the City.

Public Outreach

Planning and Building Inspection staff received input on the proposed ordinance from members of the Mountain View development community. The main comments received were regarding increased construction costs, the required number of EVSE Installed spaces compared to the demand for chargers, and the need for Level 2 versus Level 1 EVSE. The following analysis addresses these comments.

Construction Cost

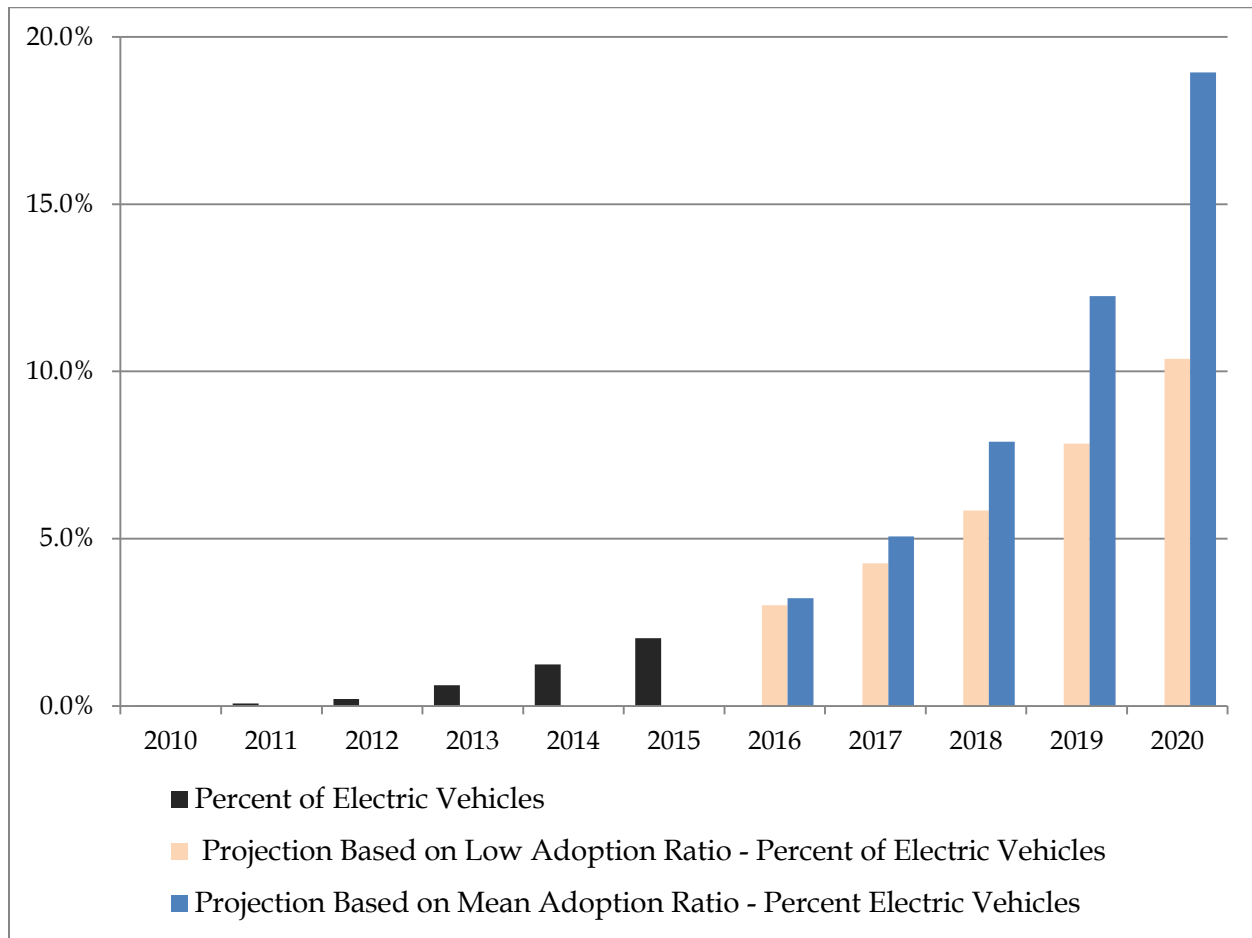
One of the purposes of the proposed ordinance is to require rewiring for EV charging systems in new buildings to lower their future installation costs. By rewiring buildings and parking areas, future EV charging systems can be installed later at a minimal cost. Based on staff analysis, the ordinance would result in an increase in construction costs of 0.7 percent for nonresidential structures, 0.2 percent for multi-family residential structures with attached private parking, and 0.5 percent for multi-family residential structures with detached nondeeded parking. Exhibit 2 contains more information on construction costs due to the proposed ordinance.

Demand for EV Infrastructure

Mountain View currently has one of the largest ratios of EVs per capita in the world. Surrounding communities, from where many people commute into the City for work, also have high numbers of EV usage. While there are many factors that influence EV usage, current purchasing trends indicate that Mountain View's EV stock will increase exponentially in the coming years in comparison to the total number of vehicles.

Using U.S. Census data (aggregate number of vehicles owned by Mountain View residents) and Clean Vehicle Rebate Project Statistics for ownership of EVs, staff projected the percent of vehicles that will be electric by 2020. The analysis revealed that by 2020, 10 percent to 19 percent of all vehicles in Mountain View will be electric (Figure 2). These findings are consistent with an April 2013 report by the International Energy Agency (IEA) which projected that 15 percent of the world's vehicle fleet will be electric by the year 2020. The IEA report has been cited in a publication by the Association of Bay Area Governments (ABAG) titled *Ready, Set, Charge California: A Guide to EV-Ready Communities*. Additionally, the University of California, Berkeley, completed research in 2012 with the California Electric Transportation Coalition, CalEPA, Natural Resource Defense Council, Electric Power Research Institute concluding that by 2030, 45 percent of light-duty vehicles in California will be electric.

Figure 2: Projected EV Fleet as a Percentage of Total Vehicles in Mountain View



Staff analysis of data from: Center for Sustainable Energy, California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated [July 20, 2015] and U.S. Census Bureau, 2009-2013 5-Year American Community Survey. "Aggregate Number of Vehicles Available by Tenure."

Based on analysis of current EV purchasing trends and projections by the IEA, staff proposes that the City require EV infrastructure at 15 percent of parking spaces in new construction.

Level 2 versus Level 1 EVSE

Level 2 EVSE (240V outlet) is the industry standard. While Level 1 EVSE (120V outlet) can be used to charge a vehicle, the average charge times are not conducive to an eight-hour workday or an overnight charge. Level 2 EVSE more closely fits the charging needs of EV users. Table 3 contains the average charge times and ranges of three popular EVs. As the market moves toward faster charging and longer ranges, Level 1 EVSE will become obsolete. For an explanation of the technical aspects of EV charging, see Exhibit 4.

Table 3: Average Charge Time and Range By Vehicle

Vehicle	Range	Charge Time		
		Level 1 Charger	Level 2 Charger	Fast Charger
2015 Nissan Leaf	84 miles	21 hours	4 hours	0.5 hours
2015 Chevy Volt	38 mile EV, 380 total*	13 hours	5 hours	N/A
2015 Tesla Model S	270 miles	63 hours	10 hours	1 hour

**Chevy Volt is a hybrid vehicle.*

ENVIRONMENTAL REVIEW

The proposed ordinance is exempt from the California Environmental Quality Act (CEQA) under Section 15308, "Actions by Regulatory Agencies for the Protection of the Environment."

NEXT STEPS

Following a recommendation from the EPC the project will be considered at a City Council public hearing in early 2016.

CONCLUSION

Staff recommends that the EPC recommend adoption of the Electric Vehicle Readiness Ordinance to the City Council.

ALTERNATIVES

1. Modify the proposed code amendment.
2. Deny the proposed code amendment.

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CB/7/CDD
891-09-02-15SR-E

- Exhibits:
1. Electric Vehicle Readiness Ordinance
 2. Cost Analysis
 3. Comparison with Ordinances of Surrounding Cities
 4. Explanation of Electric Vehicle Charging Infrastructure
 5. References

ORDINANCE NO.

AN ORDINANCE AMENDING CHAPTER 8, ARTICLE I, DIVISION III, OF THE
MOUNTAIN VIEW CITY CODE RELATING TO THE ADOPTION OF THE 2013
CALIFORNIA GREEN BUILDING STANDARDS CODE TO INCLUDE
ADDITIONAL ELECTRIC VEHICLE CHARGING REQUIREMENTS

WHEREAS, on November 3, 2009, the Council approved communitywide greenhouse gas reduction targets which align with the City with the provisions of California Assembly Bill 32 (Global Warming Solutions Act). Implementation of the Electric Vehicle Readiness Ordinance will help achieve greenhouse gas reduction targets; and

WHEREAS, the California Green Building Standards Code Section 101.7 provides that a local government may establish more stringent building standards if they are reasonably necessary due to local climatic, geological, topographical, or environmental conditions; and

WHEREAS, the Public Resource Code Section 25402.1(h)(2) states that a local enforcement agency may adopt more restrictive energy standards when they are cost effective and approved by the California Energy Commission; and

WHEREAS, the City of Mountain View has local conditions which allow amendments to the California Green Building Standards Code to add local green building and energy requirements to achieve local and regional goals and initiatives; and

WHEREAS, the City of Mountain View has made amendments and adopted the California Building Codes as Chapter 8, Article I, Division III, to address environmental conditions;

NOW, THEREFORE, THE ENVIRONMENTAL PLANNING COMMISSION OF THE CITY OF MOUNTAIN VIEW RECOMMENDS ADOPTION AS FOLLOWS:

Section 1. Article I, Division III of Chapter 8 of the Mountain View City Code is amended as follows:

“SEC. 8.20.28. Section 202 amended – Definitions.

Section 202 of the 2013 California Green Building Standards Code is amended to add the following definitions:

CONDUIT ONLY. At minimum: (1) panel capable to accommodate a dedicated branch circuit and service capacity to install at least a 208/240 V, 50 amperes grounded AC outlet; and (2) raceway or wiring with capacity to accommodate a 100-ampere circuit; terminating in (3) a listed cabinet, box, enclosure or NEMA receptacle. The raceway shall be installed so that minimal removal of materials is necessary to complete the final installation.

EVSE INSTALLED. An installed Level 2 EVSE.

EVSE-READY OUTLET. At minimum: (1) panel capable to accommodate a dedicated branch circuit and service capacity to install at least a 208/240V, 50 amperes grounded AC outlet; (2) a two-pole circuit breaker; (3) raceway with capacity to accommodate a 100-ampere circuit; (4) 50-ampere wiring; terminating in (5) a 50-ampere NEMA receptacle in a covered outlet box.

LEVEL 2 EVSE. An EVSE capable of charging at 30 amperes or higher at 208 or 240 VAC. An EVSE capable of charging at 30 amperes for each of two vehicles shall be counted as two Level 2 EVSE.

SEC. _____ Subsection 4.102.1 amended – Definitions.

Subsection 4.102.1 of the 2013 California Green Building Standards Code is amended to add the following terms:

4.102.1 Definitions. The following terms are defined in Chapter 2.

CONDUIT ONLY.

EVCS.

EVSE.

EVSE INSTALLED.

EVSE-READY OUTLET.

LEVEL 2 EVSE.

SEC. 8.20.30 Subsection 4.106.4 amended—Electric vehicle (EV) charging for new construction.

Subsection 4.106.4 of the 2013 California Green Building Standards Code is amended to read as follows:

4.106.4 Electric vehicle (EV) charging for new construction. New construction shall comply with Sections 4.106.4.1 and 4.106.4.2 to facilitate future installation and use of EV chargers. EVSE shall be installed in accordance with the California Electrical Code, Article 625.

Exception: On a case-by-case basis, where the local enforcing agency has determined EV charging and infrastructure are not feasible based upon one or more of the following conditions:

1. Where there is no commercial power supply.
2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the homeowner or the developer by more than \$400.00 per dwelling unit.

Exception: Other preinstallation methods approved by the local enforcing agency that provide sufficient conductor sizing and service capacity to install Level 2 EVSE.

SEC. 8.20.30 Subsection 4.106.4.1 amended—New one- and two-family dwellings and multi-family units with attached private parking.

Subsection 4.106.4.1 of the 2013 California Green Building Standards Code is amended to read as follows:

4.106.4.1 New one- and two-family dwellings and multi-family units with attached private parking. For each dwelling unit, the property owner shall provide Conduit Only, EVSE-Ready Outlet or EVSE Installed for each residence.

SEC. 8.20.30 Subsection 4.106.4.1.2 added – Location.

Subsection 4.106.4.1.2 of the 2013 California Green Building Standards Code to read as follows:

4.106.4.1.2 Location. The proposed location of a charging station may be internal or external to the dwelling, and shall be in close proximity to an on-site parking space consistent with city guidelines, rules and regulations.

SEC. 8.20.30 Subsection 4.106.4.2 amended – New multifamily dwellings.

Subsection 4.106.4.2 of the 2013 California Green Building Standards Code is amended to read as follows:

4.106.4.2 New multi-family dwellings. Where three or more new multi-family dwelling units are constructed on a building site, the following standards apply:

1. Resident Parking. The property owner shall provide EVSE-Ready Outlet for at least fifty (50) percent of resident parking to be assigned to residents as requested.
2. Guest Parking. The property owner shall provide EVSE Installed for at least fifteen (15) percent of guest parking spaces, but not for less than one space.
3. Accessible Spaces. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces.

SEC. 8.20.30 Subsection 4.106.4.2.4 amended – Multiple EVCS required.

Subsection 4.106.4.2.4 of the 2013 California Green Building Standards Code is amended to read as follows:

4.106.4.2.4 Multiple EVCS required. When multiple charging spaces are required, plans shall include the location and type of EVSE, raceway method(s), wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EVCS at the full rated amperage of the EVSE. Plan design shall be based upon Level 2 EVSE electrical current demands of not less than one hundred twenty-five (125) percent of the maximum load of the EVSE.

SEC. _____ Subsection 5.102.1 amended – Definitions.

Subsection 5.102.1 of the 2013 California Green Building Standards Code is amended to add the following terms:

5.102.1 Definitions. The following terms are defined in Chapter 2.

CONDUIT ONLY.

EVCS.

EVSE.

EVSE INSTALLED.

EVSE-READY OUTLET.

LEVEL 2 EVSE.

SEC. 8.20.30 Section 5.106.5.3 amended – Electric vehicle (EV) charging.

Section 5.106.5.3 of the 2013 California Green Building Standards Code is amended to read as follows:

5.106.5.3 Electric vehicle (EV) charging. [N] At least fifteen (15) percent of the total parking spaces, but not less than one, shall be EVSE Installed. When EVSE(s) is/are installed, it shall be in accordance with the California Building Code, the California Electrical Code and as follows:

Exception: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.
2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

Exception: Other preinstallation methods approved by the local enforcing agency that provide sufficient conductor sizing and service capacity to install Level 2 EVSE.

SEC. 8.20.30 Section 5.106.5.3.1 amended – Accessible spaces.

Section 5.106.5.3.1 of the 2013 California Green Building Standards Code is amended to read as follows:

5.106.5.3.1 Accessible spaces. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces.

SEC. 8.20.30 Section 5.106.5.3.2 amended – Multiple charging space requirements.

Section 5.106.5.3.2 of the 2013 California Green Building Standards Code is amended to read as follows:

5.106.5.3.2 Multiple charging space requirements. [N] When multiple charging spaces are required, plans shall include the location and type of EVSE, raceway method(s), wiring schematics and electrical load calculations to verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EVCS at the full rated amperage of the EVSE. Plan design shall be based upon Level 2 EVSE electrical current demands of not less than one hundred twenty-five (125) percent of the maximum load of the EVSE.

SEC. 8.20.30 Section 5.106.5.3.3 amended – Shared Parking.

Section 5.106.5.3.3 of the 2013 California Green Building Standards Code is amended to read as follows:

5.106.5.3.3 Shared Parking. When parking is provided to new buildings from shared parking lots, including existing and new parking lots, the requirements of this section may be met through the installation of EVSE among both the existing and new parking lots. EVSE previously installed in shared parking lots servicing new building may also meet the requirements of this section.”

Section 2. The provisions of this ordinance shall be effective thirty (30) days from and after the date of its adoption.

Section 3. If any section, subsection, sentence, clause, or phrase of this ordinance is for any reason held to be unconstitutional, such decision shall not affect the validity of the other remaining portions of this ordinance. The City Council hereby declares that it would have passed this ordinance and each section, subsection, sentence, clause, or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, or phrases be declared unconstitutional.

Section 4. Pursuant to Section 522 of the Mountain View City Charter, it is ordered that copies of the foregoing proposed ordinance be posted at least two (2) days prior to its adoption in three (3) prominent places in the City and that a single publication be made to the official newspaper of the City of a notice setting forth the title of the ordinance, the date of its introduction, and a list of the places where copies of the proposed ordinance are posted.

Section 5. This ordinance is not subject to the California Environmental Quality Act ("CEQA") pursuant to Sections 15060(c)(2) of the CEQA Guidelines (Title 14, Chapter 3 of the California Code of Regulations) (the activity will not result in a direct or reasonable foreseeable indirect physical change in the environment) and 15060(c)(3) (the activity is not a project as defined in Section 15378 of the CEQA Guidelines because it has no potential for resulting in physical change to the environment, directly or indirectly).

DRAFT

EVSE COST ANALYSIS

Staff developed a cost analysis and assumptions for the application of the proposed ordinance. The cost of basic materials and installation were provided by industry experts in the Palo Alto EVSE Task Force (when Palo Alto's ordinance was created in 2014).

The scenario assumptions below are based on the average size of structures for permits issued in the past two years in the City of Mountain View. The estimated costs for typical construction activities related to EVSE installation are listed in Table B-1. The costs listed address the following items: conduit material (also called "raceway"), wiring material, electrical panel circuits, protective circuit materials, and charger technology. The cost estimates also include the labor associated with installation.

Table B-1: EVSE Materials and Installation Cost

Item	Estimated Costs		
	Ave.	Low	High
Basic Materials			
100' of Raceway for One Parking Spot (materials only)	\$214	\$170	\$235
Installation of 100' of Raceway Only	\$646	\$515	\$710
100' of 240V/50A Wiring for One Parking Spot (materials only)	\$186	\$170	\$205
Installation of 100' of Wiring Only	\$450	\$360	\$495
Installation of 100' of Raceway and Wiring (material and install)	\$1,496	\$1,401	\$1,713
Panel Capacity Supporting One 240V/50A Circuit (per circuit)	\$400	\$390	\$440
Protective Requirements Per 240V/50A Circuit (disconnect)	\$450	\$360	\$500
EVSE Equipment			
Basic Single-Head Level 2 Charger (Non-networked EVSE single head)	\$1,000	\$800	\$1,500
Fully Featured Single-Head Level 2 Charger (Networked EVSE single head)	\$6,000	\$5,000	\$8,000
Basic Dual-Head Level 2 Charger (Non-networked EVSE double head)	\$2,000	\$1,500	\$3,000
Fully Featured Dual-Head Level 2 Charger (Networked EVSE double head)	\$7,500	\$5,500	\$8,000

The average cost estimations from Table B-1 have been applied to typical construction scenarios in Mountain View and are illustrated below. The scenarios assume no

parking reductions, although actual EVSE requirements will decrease proportionally to parking reductions.

New Single-Family Residence Construction Cost Analysis Scenario

This scenario assumes a new single-family residence with an attached garage and 100' average distance from the electrical panel to garage. For this scope, the electric vehicle requirement is one Conduit Only parking space.

Scenario Assumptions. A single-family residence with one required covered parking space and a total of two spaces. The scenario requires the installation of one raceway from the covered parking space to the electrical panel with dedicated service capacity to install at least a 208/240V, 50 ampere grounded AC outlet.

100' Average Distance to One Parking Space with Conduit Only	
Construction Category	Cost
Conduit for One Parking Space	\$214
Total	\$214

New Multi-Family Residential (Attached Private Garage) EVSE Cost Analysis Scenario

This scenario uses the approximate average size of multi-family residential projects for building permits issued in Mountain View in 2014 and 2015. The average is 42,602 square feet and 18.1 units (rounded to 42,600 square feet and 20 units for this scenario).

The cost estimate for a new multi-family residential structure is \$300 per square foot. This estimate was obtained from Reed Construction Data, an industry standard source for cost estimating. The estimated EVSE cost for the new multi-family scenario is \$23,892 or approximately \$1,195 per unit. The estimated EVSE cost would increase the overall cost to the project by 0.19 percent (\$0.56 per square foot).

Scenario Assumptions. A 20-unit residential rowhouse building with 40 private attached resident parking spaces and 7 spaces dedicated to guest parking. This scenario requires 20 Conduit Only spaces for residents. For guests, 2 EVSE Installed parking spaces are required (1 parking space and 1 ADA parking space).

100' of Average Distance to 2 Parking Spaces with Chargers	
Construction Category	Cost
240V/50A Conduit and Wiring for 2 Parking Spaces	\$2,992
Panel Capacity for 2 Parking Spaces	\$800
Protective Requirements Per 240V/50A Circuit (disconnect)	\$900
One Basic Dual-Head Level 2 Charger Servicing 2 Parking Spaces	\$2,000
Subtotal	\$6,692
100' Average Distance to the 20 Spaces with Conduit-Only	
Construction Category	Cost
Conduit for 20 Parking Spaces	\$4,280
Installation for 20 Parking Spaces	\$12,920
Subtotal	\$17,200
Total	\$23,892

New Multi-Family Residential (Detached Parking) EVSE Cost Analysis Scenario

This scenario uses the approximate average size of multi-family residential projects for building permits issued in Mountain View in 2014 and 2015. The average is 123,088 square feet and 92.5 units (rounded to 123,000 square feet and 93 units for this scenario).

The cost estimate for a new multi-family residential structure is \$300 per square foot. This estimate was obtained from Reed Construction Data, an industry standard source for cost estimating. The estimated EVSE cost for the new multi-family scenario is \$177,604, or approximately \$1,909 per unit. The estimated EVSE cost would increase the overall cost to the project by 0.48 percent (\$1.44 per square foot).

Scenario Assumptions. A 93-unit residential apartment building with 140 resident parking spaces and 21 spaces dedicated to guest parking. This scenario requires 70 EVSE-Ready Outlet spaces for residents. For guests, 4 EVSE Installed parking spots are required (3 parking spaces, 1 ADA parking space).

100' of Average Distance to 4 Parking Spaces with Chargers	
Construction Category	Cost
240V/50A Conduit and Wiring for 4 Parking Spaces	\$5,984
Panel Capacity for 4 Parking Spaces	\$1,600
Protective Requirements Per 240V/50A Circuit (disconnect)	\$1,800
Two Basic Dual-Head Level 2 Chargers Servicing 4 Parking Spaces	\$4,000
Subtotal	\$13,384
100' Average Distance to the 93 Spaces with EVSE-Ready Outlets	
Construction Category	Cost
240V/50A Conduit and Wiring for 70 Parking Spaces	\$104,720
Panel Capacity for 70 Parking Spaces	\$28,000
Protective Requirements Per 240V/50A Circuit (disconnect)	\$31,500
Subtotal	\$164,220
Total	\$177,604

New Nonresidential Construction Cost Analysis Scenario

This scenario uses the approximate average size of commercial office buildings for building permits issued in Mountain View in 2014 and 2015. The average is 105,807 square feet (rounded to 106,000 square feet for this scenario).

The overall new construction cost is estimated at \$250 per square foot. This estimate was obtained from Reed Construction Data, an industry standard source for cost estimating. The estimated EVSE cost for this scenario is \$177,338. The estimated EVSE cost would increase the overall cost of the project by 0.67 percent (\$1.67 per square foot).

Scenario Assumptions. A 106,000 square foot commercial office building with 353 parking spaces, 7 of which are accessible. This scenario requires 53 fully functional installed EVSE (52 parking spaces and 1 ADA parking space).

100' of Average Distance to 53 Parking Spaces with Chargers	
Construction Category	Cost
240V/50A Conduit and Wiring for 53 Parking Spaces	\$79,288
Panel Capacity for 53 Parking Spaces	\$21,200
Protective Requirements Per 240V/50A Circuit (disconnect)	\$23,850
26 Basic Dual-Head Level 2 Chargers and 1 Basic Single-Head Level 2 Charger Servicing 53 Parking Spaces	\$53,000
Total	\$177,338

Revenue Generation

Revenue generation can also result from the installation of EVSE. In the case of EVSE with simple technology, the charging station only allows for no-cost charging by the EVSE owner. In the case of more advanced EVSE technology, the equipment owner may elect to require a fee for use of the charging station. In either condition, the potential revenue created for EVSE owners should be considered when analyzing the cost analysis and payback period of EVSE.

COMPARISON WITH ORDINANCES OF SURROUNDING JURISDICTIONS

Surrounding jurisdictions that have adopted or are in the process of adopting EVSE ordinances are the City of Sunnyvale, the City of Palo Alto, the City of Cupertino, and the County of Santa Clara.

The Electric Vehicle Readiness Ordinance is similar to that of other jurisdictions in its requirements for one- and two-family residential. However, the proposed ordinance requires a larger ratio of EVSE Installed in nonresidential and residential guest parking compared to other jurisdictions, which require larger ratios of Conduit Only or EVSE-Ready Outlets. This deviation is designed for simplicity, ease of inspection, and the immediate availability of necessary electric vehicle charging infrastructure.

Table C-1: Summary of EV Ordinances from Surroundings Jurisdictions

	Land Use	Type of Parking	Conduit Only	EVSE-Ready Outlet	EVSE Installed
Palo Alto	New One- and Two- Family Residential	Required Per Unit	1 Space		
	New Multi-Family Residential (Attached Private Parking)	Required Per Unit	1 Space		
		Required Guest Parking		20%	5%
		Required Accessible Parking		20%	5%
	New Multi-Family Residential	Required Per Unit		1 Space	
		Required Guest Parking		20%	5%
		Required Accessible Parking		20%	5%
	New Nonresidential Other than Hotels	Required Parking		20%	5%
		Required Accessible Parking		20%	5%
	New Hotels	Required Parking		20%	10%
		Required Accessible Parking		20%	10%

	Land Use	Type of Parking	Conduit Only	EVSE-Ready Outlet	EVSE Installed
Santa Clara County	One- and Two-Family Residential (New and Rebuild*)	Required Per Unit	1 Space		
	New Multi-Family Residential	Total Required Parking Less Than 100 Spaces	3%		
		Total Required Parking of 100 or More Spaces	2%		1%
	New Nonresidential	Total Required Parking Less Than 100 Spaces	5%		
		Total Required Parking of 100 or More Spaces	4%		1%
Sunnyvale	New Residential with Private Garage	Required Per Unit		1 Space	
	New Multi-Family Residential	Required Parking		12.5%	
		Required Accessible Parking		1 Space	
	New Nonresidential (Industrial, Research and Development, Office)	Required Parking		3%	
		Required Accessible Parking		1 Space	
Cupertino	One- and Two-Family Residential (New and Rebuild*)	Required Per Unit		1 Space	
	New Multi-Family Residential	Required Parking		5%	
	New Nonresidential	Required Parking		10%	

Note. All requirements are for Level 2 EVSE.

* Rebuild. Remodels that qualify as a "rebuild" are those that include a panel upgrade or construction between the panel and the parking area.

EXPLANATION OF ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

Charging Equipment

Charging equipment for plug-in hybrid vehicles (PHEVs) and all-electric vehicles (EVs) is classified by the rate at which the batteries are charged. Charging times vary based on how depleted the battery is, how much energy it holds, the type of battery, and the type of EVSE. The charging time can range from 15 minutes to 60 hours, depending on these factors.

AC Level 1 Charging

AC Level 1 EVSE (often referred to simply as Level 1) provides charging through 120 volt (V) AC plug and requires electrical installation per the National Electrical Code. On one end of the AC Level 1 EVSE cord set is a standard, three-prong household plug (NEMA 5-15). On the other end is a J1772 standard connector, which plugs into the vehicle.

Based on the battery type and vehicle, AC Level 1 charging adds about 2 to 5 miles of range to a PEV per hour of charging time. AC Level 1 is typically used for charging when there is only a 120 V outlet available.

AC Level 2 Charging

AC Level 2 EVSE (often referred to simply as Level 2) offers charging through 240 V (typical in residential applications) or 208 V (typical in commercial applications) electrical service. AC Level 2 EVSE requires installation of home charging or public charging equipment and a dedicated circuit of 20 to 100 amps, depending on the EVSE requirements. This charging option can operate at up to 80 amperes and 19.2 kW. However, most residential AC Level 2 EVSE will operate at lower power. Many such units operate at up to 20 amperes, delivering 7.2 kW of power. These units require a dedicated 40 amp circuit.

Most homes have 240 V service available, and because AC Level 2 EVSE can charge a typical EV battery overnight, they will commonly be installed in EV owners' homes. AC Level 2 equipment uses the same connector on the vehicle that Level 1 equipment uses and all commercially available PEVs have the ability to charge from AC Level 1 and AC Level 2 EVSE. Based on the vehicle circuit capacity, AC Level 2 adds about 10 to 20 miles of range per hour of charging time.

DC Fast Charging

Direct-current (DC) fast-charging equipment, sometimes called DC Level 2 (typically 208/480 V AC three-phase input), enables rapid charging along heavy traffic corridors and at public stations. EVs quipped with either a CHAdeMO or SAE DC fast-charge receptacle can add 50 to 70 miles of range in about 20 minutes.

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